

SPECIES

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First report of two euryhaline gobiid fishes (Gobiidae Cuvier, 1816) from West Bengal, India

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ABSTRACT

West Bengal lies in the Northern part of peninsular India and has a rich variety of aquatic ecosystems such as hill streams, ponds, rivers, mangroves, mudflats, estuarine creeks and small riverine channels which holds a large ichthyofaunal diversity of as much as 610 species. The present work reports the first record of two gobiid fish's viz., *Aulopareia cyanomos* (Bleeker, 1849) and *Stigmatogobius yanamensis* Rao, 1971 from the Sunderban Biosphere Reserve of West Bengal. *Stigmatogobius yanamensis* was so far thought to have a limited distribution in the Godavari estuaries in India.

Keywords: *Aulopareia*, Mangrove, *Stigmatogobius*, Sunderban Biosphere Reserve, West Bengal.

1. INTRODUCTION

West Bengal lies in the Northernmost part of peninsular India having a coastline stretch of 220 km covering an area of 0.82 million hectares of the coastal zone (Chakraborty, 2010). The Sunderban Biosphere Reserve, a 4263 sq. km. area located in the eastern part, is this coastline's main draw (Singh et al., 2010). The primary features of Sunderban are mangrove vegetation, mudflats, creeks and small riverine channels, which operate as a nursery ground for various aquatic species and so support a large variety of fish species (Alfred et al., 2012). Ichthyofaunal diversity of West Bengal constitutes of 610 species, of which 350 species had been reported from Sunderban (Mishra and Gopi, 2017; Chatterjee et al., 2013).

Fishes belonging to the Gobioid group are taxonomically diverse and come under the Order Gobiiformes Linnaeus, 1758, has nine Families and a total of 2272 valid species found throughout the world (Venkataraman et al., 2013; Fricke et al., 2021; Keith, 2003). True gobies are members of the Gobiidae family, which includes 258 valid genera and 1930 species of fish in freshwater, brackish and marine environments (Keith, 2003). There have been a few studies done on this group in Indian waters which accounted for 237 species belonging to three families (Sreeraj C.R., Unpublished Data), of which only two families consisting of 47 species are reported from West Bengal as well as from Indian Sunderban (Alfred et al., 2012; Chatterjee et al., 2013). *Aulopareia* Smith, 1945 and *Stigmatogobius* Bleeker, 1874 are genera under the family Gobiidae and

represented by 5 species and 7 species worldwide respectively of which only *S. sadanundio* was reported from West Bengal (Vasileva and Bogorodskii, 2004). The above study demonstrates the existence of two species of Gobiidae first from Sunderban Biosphere Reserve of West Bengal.

2. MATERIALS AND METHODS

On 1st March 2019 a specimen of *A. cyanomos* was caught in estuarine waters close to the northern coastal region of Dhanchi Island (Figure 1), Sunderban Biosphere Reserve ($21^{\circ}42'34.77''N$; $88^{\circ}27'25.63''E$) by a local boatman using small cast net. On 25th December 2019 a specimen of *S. yanamensis* was obtained from tiny mud pools filled with brackish water in the Sunderban Biosphere Reserve's Pakhir Dweep ($22^{\circ}8'49.55''N$; $88^{\circ}51'11.47''E$), which is close to Pakhiralaya Island (Figure 1), using a small aquarium scoop net. A field probe (Erma, PSU-030) was used to determine the salinity level of the study site. The collected specimens were treated in a 10% formalin solution (in seawater) and then preserved in 70% ethanol for long-term storage. For additional DNA analysis, the specimens' body parts were also stored directly in 100% ethanol. The preserved specimens are deposited in the National Zoological Collections of the Zoological Survey of India, Sunderban Regional Centre. The diagnostic features that were used in morphological identification of specimens were based on (Larson and Jaafar, 2022; Rao, 1971). Classification of the species is based on (Froese and Pauly, 2021). Catalogue of fishes (Fricke et al., 2021). Electronic calipers were used to measure all morphometric details to the closest 0.1 mm.



Figure 1 Map showing the collection sites from Sunderban Biosphere Reserve

3. RESULTS

The details of the newly reported species are given below:

Class: Actinopterygii

Order: Gobiiformes

Family: Gobiidae

Genus: *Aulopareia* Smith, 1945

***Aulopareia cyanomos* (Bleeker, 1849)**

1849. *Gobius cyanomos* Bleeker, *Verhandelingen van het Bataviaasch Genootschap van Kunstenen Wetenschappen*, 22:6

1989. *Acentrogobius cyanomos* (Bleeker, 1849). Ataur Rahman, A. K. Freshwater fishes of Bangladesh. *The Zoological Society of Bangladesh*.ii-xvii + 1-364

2022. *Aulopareia cyanomos* (Bleeker, 1849). Larson, H. K. and Z. Jaafar, A review of the gobiid fish genus *Aulopareia* (Gobiidae: Gobiinae) with description of a new species from Kuwait and discussion of the status of *Gobius cyanomos* Bleeker. *Zootaxa* 5155 (no. 4): 493-516.

Common Name

Threadfin blue goby

Conservation Status

Least Concern (IUCN 3.1) (IUCN Red List)

Material examined

ZSI/SbRC/KN 2852, 1 ex., TL 11.6cm, SL 9.2cm, Dhanchi Island, Sunderban Biosphere Reserve (21°42'34.77"N; 88°27'25.63"E), 1.3.2020, Coll: Arya Sen.

Diagnostic Characters

1st Dorsal spines 6; 2nd Dorsal spine 1; 2nd Dorsal soft rays 11; Anal spine 1; Anal soft rays 9; Ventral spine 1; Ventral soft rays 5; Pectoral soft rays 20; Caudal soft rays 12. Body rounded in lateral profile anteriorly but laterally compressed posteriorly, snout is flattened. Head moderately cylindrical; jaws equal; gill opening not extended anteriorly. Some spines of first dorsal in the middle elongate. Pelvic fins united medially; presence of frenum. Most scales ctenoid; scales on pectoral base, breast, nape cycloid; naked operculum. Pores, sensory canals present on head; longitudinal sensory papillae rows on cheek. Caudal fin is diamond shaped with pointed end. Dorsal profile of head slanted downward anteriorly, Caudal peduncle without groove. Interorbital space little convex.

Body-color of the dorsal profile is light brown to yellow and little silvery ventrally. Black triangular spot present just above dorsal of gill opening. 5 mid-lateral dusky spots on body. Numerous pale blue-green spots on body, dorsal and caudal fin. 2nd dorsal and anal dark bearing reddish outer edge. Ventral and most of the caudal fins grey. Caudal fin having a dark Red to Orange coloration on the dorsal margin (Figure 2a, b). Detailed measurement of the specimen is given (Table 1).

Habitat

River Channel, Brackish Water (Salinity: 3-5 ppt).

Distribution

India: Mangroves of Tamilnadu, Odisha, Andhra Pradesh (Chakraborty et al., 2017). Elsewhere: Thailand, Malaysia, Indonesia, Bangladesh, China, Philippines and Fiji Islands (Vasileva and Bogorodskii, 2004; AqGRISI, 2019).

Remarks

Type specimen was collected from Madura Straits near Surabaya and Kammal, Java, Indonesia (AqGRISI, 2019). This species was first described as *Gobius cyanomos* by Bleeker in 1849. Later Ataur Rahman 1989 placed this species under *Acentrogobius*⁷. Larson and Zafar, 2022 placed the species under the genus *Aulopareia* Smith, 1945. Presence of elongated infraorbital pore and absence of post-orbital pore and presence of a single inter-orbital pore are the characters, which distinguishes *Aulopareia* from *Acentrogobius*.

Genus

Stigmatogobius Bleeker, 1874

Table 1 Morphometric measurements of the newly reported species from West Bengal

Characters	<i>A. cyanomos</i>	<i>S. yanamensis</i>
Total Length (TL)	11.6cm	25mm
Standard Length (SL)	9.21cm	20.3mm
Head Length (HL)	2.43cm	5.6mm
Eye Diameter	0.42cm	0.9mm
Inter Orbital Length	0.41cm	0.6mm
Snout Length	0.32cm	0.8mm
Pectoral Fin Length	1.84cm	3.9mm
Pelvic Fin length	1.94cm	2.2mm
Anal Fin Length	1.12cm	4.2mm
Pre-dorsal Length	5.93cm	7.6mm
Pre-anal Length	3.37cm	10.6mm
Pre-pectoral Length	2.82cm	6.3mm
Pre-pelvic Length	2.85cm	5.1mm
Body Depth	2.31cm	2.9mm
Upper Jaw Length	1.13cm	2.4mm
Caudal Peduncle Length	1.92cm	3.1mm
Caudal Peduncle Depth	1.32cm	2.3mm
Caudal Fin Length	2.36cm	4.5mm

***Stigmatogobius yanamensis* Rao, 1971**

1971. *Stigmatogobius yanamensis* Visweswara Rao, *Journal of the Zoological Society of India*, 23:1

2005. *Pseudogobius yanamensis* Rao, 1971. Larson, H. K., A revision of the gobiidae genus *Stigmatogobius* (Teleostei: Gobiidae), with descriptions of two new species. *Ichthyological Exploration of Freshwaters* 16:4

Common Name

Barfin fatnose goby

Conservation Status

Not Enlisted (IUCN 3.1) (IUCN Red List)

Material examined

ZSI/SbRC/KN 3353, 1 ex., TL 25mm, SL 20.3mm, Pakhir Dweep near Pakhiralaya, Sunderban Biosphere Reserve (22° 8'49.55"N; 88°51'11.47"E), 25.12.2019, Coll: Arya Sen. (Figure 2c, d). ZSI/SbRC/KN 3133, 1 ex., TL 28mm, SL 23.2mm, Coringa Wild Life Sanctuary (16°49'53"N; 82°20'12"E), 11.12.2020, Coll: Dr. Sreeraj, C.R.

Diagnostic Characters

1st Dorsal spines 6; 2nd Dorsal spine 1; 2nd Dorsal soft rays 7; Anal spine 1; Anal soft rays 7; Ventral spine 1; Ventral soft rays 5; Pectoral soft rays 15; Caudal soft rays 14. Elongate body. Body rounded in lateral profile anteriorly but laterally compressed posteriorly, snout is rounded at tip. Small teeth in several rows on both jaws. Caudal oblong as head. Opercle scaled. Dorsal profile straight and ventral profile bulges at near pelvic base. Eyes placed dorso-laterally. Small mouth with oblique opening and shorter lower jaw. Tongue anteriorly grooved and pointed at middle. Gill opening restricted before base of pectoral. Pectoral and caudal fin rounded. Pelvic slightly longer than pectoral. Body covered with ctenoid scales, six series of longitudinal rows between base of 2nd dorsal and anal origin.

Body-color of the dorsal and lateral profile is very light green to olivaceous and little silvery ventrally. Scale edges are darker in head region; presence of numerous black dots; presence of distinct 5-7 black bands. Dusky caudal fin. 5 dark blotches in a line on the lateral profile. 3 dark blotches in shape of a triangle on the caudal peduncle region (Figure 2c, d). Black stripe on the first dorsal after middle portion. Detailed measurement of the specimen is given (Table 1).

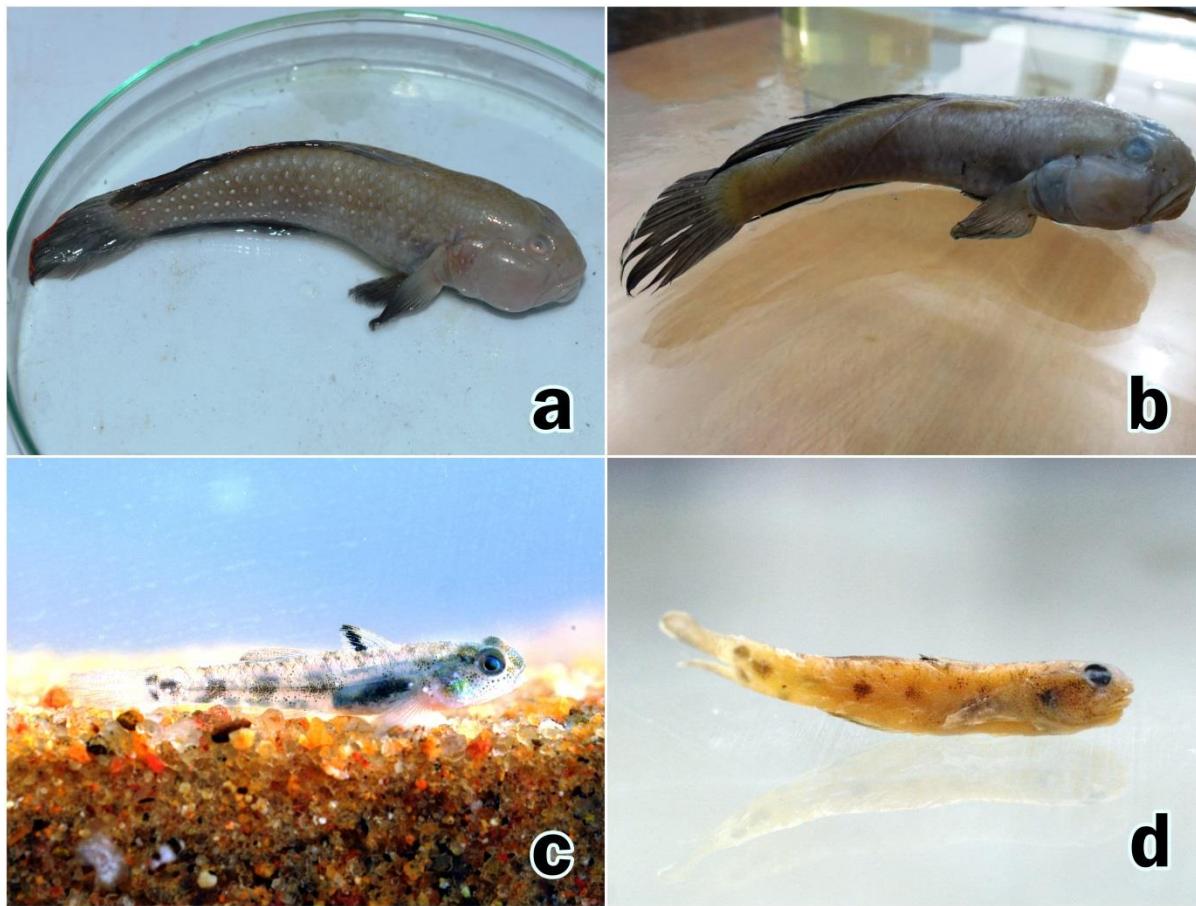


Figure 2 Photographs of newly reported fishes. A & B: Fresh and preserved specimen of *Acentrogobius cyanomos* (Bleeker, 1849). C & D: Fresh and preserved specimen of *Stigmatogobius yanamensis* Rao, 1971.

Habitat

Temporary mangrove mud pools, created inland at the time of low tide having interconnected channels underground. Brackish Water (Salinity: 0-3 ppt)

Distribution

India: Godavari estuary in Andhra Pradesh (Rao, 1971). Elsewhere: Vietnam, Singapore (Venkateswarlu and Ramarao, 1986; Tan and Lim, 2019).

Remarks

This species can be differentiated from its commonly related species by its distinctive vertical sub-marginal bluish-black bar on the first dorsal fin and four dusky blotches on the side behind the anus, the rearmost blotch is almost joined to two similar blotches at the base of the caudal fin (Tran et al., 2013). Also, the transparent anal fin, truncated caudal fin and a smaller number of lateral line scales helps in the identification. Study of the specimens Collected from the type locality, i.e., from Coringa Wildlife Sanctuary of Godavary estuary, by the authors also supports the original description of the species and provides the fact of *S. yanamensis* being a valid species.

The species was described as *S. yanamensis* by Visweswara Rao from the Godavari estuary in India (Rao, 1971). Talwar and Jhingran, (1991) discussed this species as a questionable synonym of *S. minima* Hora, 1923 without any suitable justification. Although the present study as well as the study by Larson and Hammer, (2021), gives justification of *S. yanamensis* to be a separate valid species. The holotype and six paratypes are held at the Zoology Museum, Andhra University, Waltair (Fricke et al., 2021). Larson H.K. on the revision of *Stigmatogobius* placed this species under *Pseudogobius* Popta, 1922; without much justification (Larson, 2005). Although it seems to be poorly known, the species was again recorded from the Mekong delta in Vietnam (Tran et al., 2013). From 17 years old survey of mangroves of Singapore, this species has been identified in 2019 (Tan and Lim, 2019). Recently in 2021, Larson & Hammer in the revision of *Pseudogobius*, again removed the species from this genus because it has a different setup of

sensory canals and pores on its head and does not have the same characteristic corkscrew-shaped intestinal arrangement that is found in *Pseudogobius* (Larson et al., 2016). As well as the *S. minima* which was previously been confused with *S. yanamensis* is now placed under the genus *Pseudogobius* (Larson and Hammer, 2021). Still *S. yanamensis* has been recorded as a synonym of *S. minima* in World Register of Marine Species, accepted as a Nomen Dubium in Catalogue of Fishes and as a doubtful species from India by Parenti, (2021). Authors suggest that *S. yanamensis* should be accepted as a valid species following the current study (Rao, 1971; Larson and Hammer, 2021).

4. DISCUSSIONS

Peninsular river systems of Indo-pacific are colonized by Gobiidae having a suitable habitat choice and life cycle adapted to these climatic conditions and tidal variations (Mc-Dowall, 1988). These amphidromous fishes are named because of their life cycle where they spawn in fresh water; embryos go downstream to sea for a planktonic phase and then return to rivers for further growth and reproduction (Mc-Dowall, 1997; Mc-Dowall, 1993). Lack of studies made it unknown, why these species have grown such evolutionary characters (Chandra et al., 2019). However, these gobies are the greatest contributor to the marine and estuarine fish diversity that shows typical cryptic behavior for this habitat.

Fishes of estuaries are well documented but there is no specific study of Gobiidae from the mangrove ecosystem. It would be more appropriate if each mangrove patch can be studied separately for Gobiidae fish faunal composition. So far from Indian mangroves, 93 species belonging to 2 families under Gobiiformes are documented (Polgar, 2009). *S. yanamensis* was discovered from India, this species was only reported from Godavary estuary and also that is the type locality of this species (Rao, 1971). However, this recent collection from Sunderban Biosphere Reserve shows its distribution is quite wide spread as well as diverse. Also, the specimen collected from Coringa Wildlife Sanctuary reports the presence of this species from its type locality, almost 50 years after its original collection. All the studies done in this species are all based on old collections, so this recent discovery will surely help to study the characters as well as its habitat preference, which will eventually help us to determine its proper genera. This report extends the range of this species to West Bengal coastal mangroves and suggests its distribution all along the eastern coast mangroves of India. *S. yanamensis* and *A. cyanomos* increase the number of Gobiidae species in West Bengal to 49.

Presently most of the reported species of Indian Gobiidae lacks the information on the life cycle. The biology and ecology of these fishes should set a direct goal for the maintenance and protection of mangrove ecosystem also as they play a great dean in maintaining the ecosystem as well as they can be used as potential bio monitoring agents (Maciolek, 1978). In an estuarine region island, the effect of humans on an aquatic ecosystem is highly critical to amphidromous species (Mc-Dowall, 1997). Two-way migration of these species is being hampered as a result of habitat destruction due to industrialization, tourism, river channelization (Tran et al., 2013). Hence, a detailed study is required on the ecology of these euryhaline Gobiid fishes for better management of the mangrove ecosystem.

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Authors Contributions

AS & CRS collected and identified the specimens from field. AS: Manuscript preparation. CR and CRS: Critical analysis and overall management.

Ethics approval

Informed Consent was obtained from the Zoological Survey of India, Sunderban Regional Centre, Canning, West Bengal, India for conducting a survey to collect, preserve & identify faunal specimens for better knowledge of the diversity, as well as preparation of the ichthyofaunal catalogue of the state of West Bengal.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

The specimens used for the study were deposited in the National zoological collection of Sunderban Regional Centre, Zoological Survey of India and is available on request.

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